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ESTABLISHMENT OF A LICHEN BIOMONITORING PROGRAM  
AND BASELINE AT SELECTED SITES IN THE HIGH UNTAS  
WILDERNESS AREA, WASATCH-CACHE NATIONAL FOREST,  
UTAH

FINAL REPORT

PROVOCATION OF LICHEN

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## INTRODUCTION

### PROJECT OBJECTIVES:

1. Identify 6-8 air quality biomonitoring reference sites within the Wasatch-Cache portion of the High Uintas Wilderness Area.
2. Collect, curate, and identify lichen species from each reference site.
3. Identify and collect several (4-5) pollution-sensitive lichen species for elemental analyses from each reference site in the High Uintas Wilderness Area. Rare species will not be sampled for analysis, but their distribution will be noted.
4. Determine the baseline thallus concentrations of sulfur and one or two additional elemental pollutants (determined in consultation with Forest Service personnel), using ten replicate samples of one documented pollution-sensitive species from each reference site.
5. Prepare and submit a draft report by 31 March 1993.
6. Prepare and submit a final report detailing the results of this study by 30 November 1993. This final report will include:
  - a. a map and a brief habitat description for each reference site in the High Uintas Wilderness Area;
  - b. a checklist of lichen species from each reference site with relative abundance, growth form, pollution sensitivity, and substrate data for each species;
  - c. a list of pollution-sensitive or potentially pollution-sensitive lichen species for each reference site;
  - d. color photographs/slides of several lichen species from the High Uintas Wilderness Area known or suspected to be sensitive to air pollutants;
  - e. baseline thallus concentrations of sulfur and other pollutant elements for one indicator species from each reference site;
  - f. a list of references, protocols, equipment and supplies used in this study;
  - g. other pertinent information or unusual observations.

**LICHENS AS BIOLOGICAL INDICATORS OF AIR QUALITY:** Protocol for using lichens as bioindicators of air quality is well-documented (Fields & St.Clair 1984; St.Clair 1989; Richardson 1992). Hale (1983) noted that lichens have basically been used in three basic ways to monitor the effects of air pollution on biological systems: 1) elemental analysis of lichen tissues, 2) mapping of all (or selected) lichen species found in areas adjacent to pollution sources, 3) transplant studies. Currently, the most common approach involves a floristic survey along with elemental analyses of tissues from sensitive indicator species (St.Clair 1989; Wetmore 1989).

As lichens accumulate many different pollutants from atmospheric outwash, lichen tissues provide a record of the kinds and relative quantities of air pollutants from any particular airshed (Schutte 1977; Wetmore 1989; Rope & Pearson 1990). Pollutant accumulation patterns for specific elements have been monitored over time by correlating thallus growth rates and pollutant concentrations in excised portions of lichen thalli (Lawry & Hale 1981). Changes in lichen physiological processes indicate pollution-related damage long before other, more easily detectable changes in thallus color, morphology, or community structure become apparent (Fields & St.Clair 1984).

Lists of pollution-sensitive lichen species have commonly been published in conjunction with floristic and ecological surveys (Rushforth et al. 1982; Wetmore 1989). As certain lichen species are inherently more sensitive to airborne contaminants, air quality can be effectively monitored by occasionally reevaluating lichen community and/or physiological parameters. Pollution-related changes can then be documented by comparing follow-up data to original baseline data.

#### **GENERAL HABITAT DESCRIPTION FOR THE HIGH UNTAS**

**WILDERNESS AREA:** The Uinta Geocline, or greater Uinta Biogeographic Region, extends from 40° to 41° north latitude and from 108° 30' to 111° 30' west longitude. The area thus delimited covers approximately 28,250 km<sup>2</sup> (17,515 miles<sup>2</sup>). Geographically it encompasses six counties in two states: Wasatch, Summit, Duchesne, Uintah and Dagget counties, UT, and Moffat County CO. Southern Uinta and Sweetwater counties, WY, might also be added to include the lowest foothills on the north slope.

The Uinta Mountains are significant as the largest east-west mountain range in the contiguous fort-eight states. The entire mountain system extends about 258 km (160 miles) from Heber Valley in central Utah to the Piceance Basin in western Colorado.

North to south the system is about 100 km (60 miles) across, from the Bridger Badlands of southwest Wyoming to the Uinta Basin in northeast Utah.

Much of the western portion of the Uinta Geocline, from the foothills east of Heber Valley to Red Creek and North Fork of the Duchesne River, is within the Uinta National Forest. Continuing eastward from there the higher elevations are included in Ashley National Forest on the south slope and Wasatch-Cache National Forest on the north. A large portion of the higher elevations in these two forests (186,162 ha or about 460,000 acres) was designated High Uintas Wilderness Area by the U.S. Congress in 1984. Still further east the range gradually diminishes to foothills in the Piceance Basin, CO, with Flaming Gorge National Recreation Area and the Bridger Badlands to the northeast, and Dinosaur National Monument to the east and southeast.

Elevation in this area varies from approximately 1524 m (5000 ft.) in the Uinta Basin along the Green River, to 4123 m (13,528 ft.) on the summit of Kings Peak in the high country. This study focused on six sites in the Wasatch-Cache National Forest portion of the High Uintas Wilderness Area.

The Uinta upwarp is part of the Laramide Orogeny, beginning in late Cretaceous-early Tertiary and continuing today. The younger strata down slope are mostly sandstones, shales and conglomerates--all highly erosive compared to the hard quartzite which constitutes the massive, stable core of the Uinta Mountains. Known by geologists as the Red Creek Formation, the quartzite core is approximately 200 km long and 30 km wide, extending east to west like a massive backbone in the middle of the geocline and cresting at an average elevation of about 3350 m (11,000 ft.). Much of this quartzite-based plateau is the high country known as the High Uintas Wilderness Area.

The high country's characteristic U-shaped basins, steep-sided, deep, and oriented perpendicular to the anticlinal crest, were formed during Pleistocene glaciation episodes. During the most extensive glacial episode, glaciers covered over 2500 km<sup>2</sup> (1550 miles<sup>2</sup>) of the range and pushed out into what is now southwest Wyoming up to 60 km north from the crest (Hansen 1969). Past glacial activity is also evidenced by abundant moraines, step lakes and cirques throughout the high country. Sandstones, limestones and other erosive lithologies are present in the higher elevations in the Uinta National Forest on the western end, Dinosaur National Monument at the eastern end, and in scattered places around the fringes of the

quartzite upwarp. Mostly, however, these less stable strata are confined to lower elevations.

Originally metamorphosed from a mineral-impoverished sandstone, the Red Creek Quartzite erodes back to mineral impoverished sand, neutral to slightly acidic in pH. It is a relatively poor substrate for vegetation in the higher elevations. By contrast Phanerozoic limestones and sandstones down slope are mineral-enriched and more basic in pH. Soils derived from these younger strata are relatively fertile, but being situated in lower elevations, are subject to more xeric climatic regimes.

Extremely warm summer daytime temperatures (+40° C) commonly occur in the deserts of the lower elevations. Average January temperatures in the lower elevations range between -9° C and 2° C.

As year-round weather stations are lacking throughout much of the higher elevations, general climatic patterns must be extrapolated from valley stations (Jeppson et al. 1968). Mean yearly temperatures in the higher elevations may be as low as -17° C in January and as high as 18° C in July. Above 3000 m elevation, temperatures probably do not exceed 24° C. Subfreezing temperatures may occur throughout the year in the higher elevations, with brief snow flurries even in July and August.

Annual precipitation in the lower elevations of the Uinta Geocline ranges from approximately 15 cm to 30 cm. It is estimated that annual precipitation along the crest of Uinta Mountains exceeds 100 cm.

Winter precipitation in the Uinta Mountains derives largely from Pacific air masses which move eastward across the Rocky Mountains. However, summer precipitation is more pronounced in the eastern portion of the range, deriving from warm moist air masses moving northwest from the Gulf of Mexico. As the "monsoonal" pattern diminishes east to west, the eastern part of the range shows precipitation maxima in both summer and winter, while the western half of the range experiences only a distinct winter precipitation maximum (James 1966)).

Higher elevations receive more moisture than the lower elevations, and lose less of it through evaporation. Thus at higher elevations more moisture is consistently available for plant growth.

Altogether 1053 angiosperm species, 15 gymnosperm species and 20 pteridophyte species, for a total of 1088 species of vascular plants, have been reported from the Uinta Mountains (Harper et al. 1978).

Alpine tundra in Utah occurs mainly above 3355 m and are well developed and broadly continuous in the Uinta Mountains.

Supalpine and montane coniferous forests are extensive. Forest composition varies throughout the anticline, depending upon elevation, soil, and climatic patterns. In general, Engelmann spruce (Picea engelmannii) and lodgepole pine (Pinus contorta) are the dominant conifers throughout the subalpine quartzitic core, while ponderosa pine (Pinus ponderosa) and douglas fir (Pseudotsuga menziesii) inhabit mid-elevation zones, the latter especially in calcareous soils. Limber pine (Pinus flexilis) inhabits windswept ridges, often in cold-air sites and on calcareous soils.

The "pygmy forests" of pinyon pine (Pinus edulis) and Utah juniper (Juniperus osteosperma) occupy the vast areas in the lower slopes and foothills of the Uinta Mountains.

Deciduous forest are limited. Aspen (Populus tremuloides) communities occur at higher elevations, often in pure stands. Thickets of oak and maple scrub occur in restricted canyons at lower elevations.

North and south of the Uinta Range, the Wyoming sagebrush prairie and the Colorado Plateau are dominated by cool desert shrubs. The Uinta Plateau is in fact the northernmost development of the Colorado Plateau.

Riparian communities, consisting of cottonwood, birch, alder, box elder, willows, reeds, sedges, rushes, and cattails. follow the rivers draining the Uinta uplands.

On the eastern end of the Uinta upwarp, the sculpted sandstone canyons of Dinosaur National Monument are rich in microhabitats. Deep, narrow canyons frequently create cold air traps, supporting temperate biota at low, otherwise xeric elevations. Hanging gardens also occur with isolated often disjunct communities of ferns, orchids, sedges, and various herbaceous dicots, clinging to seeps and wet walls on protected sandstone cliffs in steep-walled canyons.

In summary the plant communities of the Uinta Mountains reflect a strong correlation between elevation and climate, but complex geology, mountainous relief, and microhabitat ecology complicate simple geographic delineations of floristic zones.

**PREVIOUS LICHENOLOGICAL INVESTIGATIONS IN THE UNTA MOUNTAINS REGION:** Until the last decade there were few extensive lichenological studies in the Greater Uinta Biogeographic Region. Tuckerman (1871) was the first to collect lichens in the Uinta Mountains, reporting twelve species. Fink (1919) next reported four species of lichens in Utah, but did not specify the exact location

within the state. Magnusson (1952, 1954) collected extensively in western North America; from Utah he named several new species, mostly collected in the Colorado Plateau of the east-central region of the state, but none from the Uinta Mountains specifically.

In the first checklist of the lichens of Utah, Flowers (1954) listed 12 lichen species from the Uinta Mountains. In his study of the alpine macrolichens of western North America, Imshaug (1957) listed 11 lichen species in the Uinta Mountains.

Lichenologic research in Utah generally increased during the 1970s and 1980s with research by Anderson and Rushforth (1976), Nash and Sigal (1981), Rushforth et al. (1982) and others.

Extensive lichenological research in the Uinta Mountains began with St. Clair's doctoral dissertation research (1984). His was an ecological study on the lichens of the Bald Mountain in the High Uintas Wilderness Area. St. Clair listed 66 lichen species from the Bald Mountain area. St. Clair's efforts were followed by the work of his graduate student, Clayton Newberry, who completed an extensive survey of the lichens of the Uinta Mountains (Newberry 1992). Newberry reported a total of 271 lichen species in 95 genera for the Uinta Mountains.

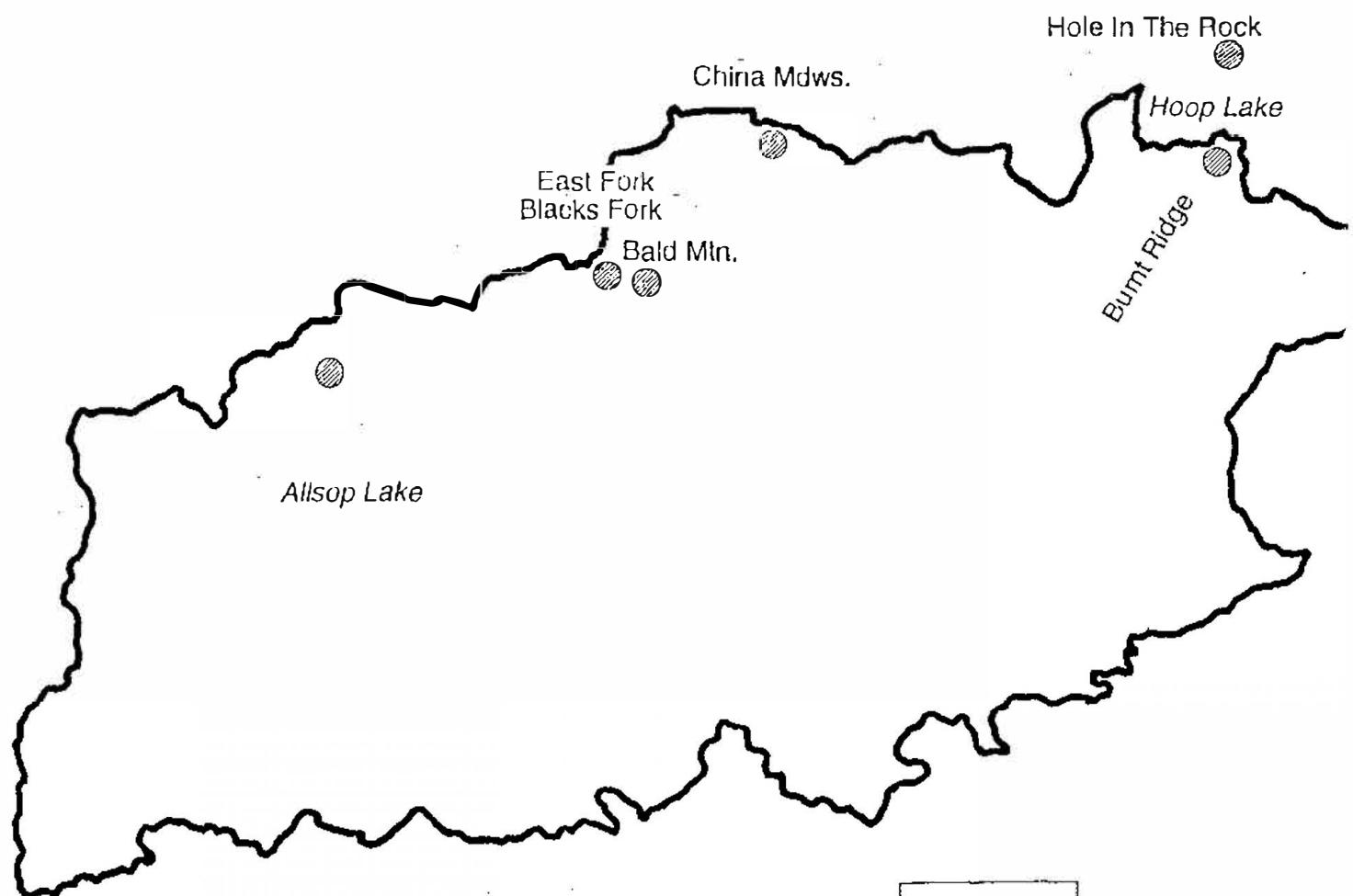
Anderson collected lichens in Dinosaur National Monument in the early 1960s, but not extensively, and listed his findings parenthetically in various publications (Anderson 1964, 1967; and Anderson and Weber 1962). Many of his original collections from Dinosaur National Monument were deposited in COLO, to be referenced in published reports by other lichenologists. Extensive lichenological studies at Dinosaur National Monument are currently being conducted by Larry St. Clair and his students.

**LICHEN BIOMONITORING REFERENCE SITES IN THE HIGH UNTAS WILDERNESS AREA:** A total of six reference sites were set up in three general areas of the Wasatch-Cache portion of the High Uintas Wilderness Area (figure 1). Two reference sites were established at the east end of the wilderness, one along Burnt Ridge and one along the ridge between Hole in the Rock Spring and Coal Mine Hill (this site was selected due to the unusual geologic substrates). A single reference site was set up along Forest Service Trail #110, south of China Meadows Trailhead. Two reference sites were established in the general vicinity of the East Fork of Blacks Fork Guard Station; one along Forest Service Trail #103, along Little East Fork River and the other along an alpine tundra ridge south of Bald Mountain. The last reference site was established along U.S. Forest Service Trail #151 in Allsop Lake Basin.

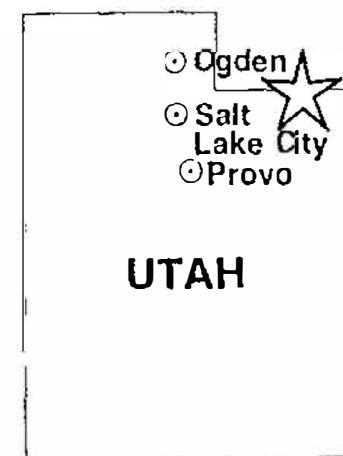
# HIGH UNTAS WILDERNESS AREA

Wasatch Cache National Forest

## Lichen Biomonitoring Program and Baseline



◎ = Reference Sites



The general location of each reference site was determined in consultation with Forest Service personnel. All available habitats and substrates at each reference site were carefully examined. Collections representing as many different species of lichens as possible were made at each reference site.

## METHODS

**COLLECTION, CURATION, IDENTIFICATION, AND DEPOSITION OF LICHEN SPECIES:** Because lichen distribution is directly influenced by substrate, moisture and sunlight, all available substrates and habitats at each reference site were carefully examined. Small amounts of each lichen species were either removed directly from the substrate, or depending on the species, with a small piece of the substrate (bark, wood, soil, or rock).

All specimens were placed in carefully labeled paper sacks and taken back to the BYU Herbarium of Nonvascular Cryptogams, where they were curated, identified, placed in permanent herbarium packets, and labeled with the current epithets and authors' names as well as detailed information about the collection site, habitat, and substrate. Herbarium numbers (BRY C-) were also assigned.

Species were identified using standard lichen keys and taxonomic treatises. Standard chemical spot tests and, where necessary, thin-layer chromatography techniques were also used to finalize species identifications.

One set of specimens collected from each reference site will be permanently housed at the BYU Herbarium of Nonvascular Cryptogams in Provo, Utah. After consultation with Forest Service personnel duplicate sets of specimens will be sent to other western U.S. herbaria.

**COLLECTION OF LICHEN THALLI FOR LABORATORY ANALYSES:** After careful consideration of species abundance, substrate, growth form, documented/suspected pollution sensitivity and general distribution patterns of the lichens at each reference site, one species at each reference site was designated as the sensitive, indicator species and used for all laboratory chemical analyses.

At each reference site sufficient material of at least one sensitive, indicator species was collected for laboratory analyses (6-10 grams dry weight). All lichen material collected for elemental analyses was placed in Hubco cloth bags (to avoid contamination) and transported back to the BYU herbarium of Nonvascular Cryptogams.

Excess material is permanently stored in Hubco cloth bags in the elemental analysis collection at the BYU Herbarium for Nonvascular Cryptogams. This material is available for additional testing upon request.

#### **DETERMINATION OF ELEMENTAL CONCENTRATIONS IN LICHEN**

**TISSUES:** In the laboratory, surface debris and dust were removed from all samples. Clean, two gram samples of one or two indicator species from each reference site were delivered to the Elemental Analysis Laboratory at Brigham Young University.

Samples were prepared for PIXE analysis using the methods of Duflou et al. (1987). Lichen samples were placed in Teflon containers with a teflon coated steel ball, cooled to liquid nitrogen temperature, powdered by brittle fracture using a Braun Mikro-Dismemberator II, and then dried in an Imperial IV Microprocessor Oven for 14 hours at 80°C. Subsamples weighing 150 mg were then weighed into teflon containers and spiked with 1 ml of a 360 ppm yttrium solution. The samples were then oven dried again for 14 hours at 80°C. Samples were then homogenized again using the microdismemberator. Approximately 1 mg of the powdered lichen was then carefully weighed onto a thin polycarbonate film in an area of 0.5 cm<sup>2</sup>. A 1.5% solution of polystyrene in toluene was used to secure the sample to the film.

Samples were analyzed using a 2 MV Van De Graaff accelerator with a 2.28 MeV proton beam which passed through a 1.1 mg/cm<sup>2</sup> pyrolytic graphite diffuser foil. The proton beam was collimated to irradiate an area of 0.38 cm<sup>2</sup> on the sample. Typically, 10-100 nA proton beam currents were used. X-rays were detected using a Tracor x-ray spectrometer, model TX-3/48-206, with a 10 mm<sup>2</sup> by a 3 mm thick Si(Li) detector positioned at 90° to the proton beam. Samples were analyzed twice using different x-ray absorbers between the samples and the detector. One was a 49 mg/cm<sup>2</sup> Mylar absorber with a 0.27 mm<sup>2</sup> area pinhole (2.8% of detector area). The Mylar was backed with a 8.5 mg/cm<sup>2</sup> beryllium foil. A 98 mg/cm<sup>2</sup> Mylar absorber was also used.

To insure adequate quality control, samples of NIST SRM 1571, orchard leaves, and other standards were also prepared and analyzed using the same procedures.

## RESULTS AND RECOMMENDATIONS

**LICHEN MATERIAL COLLECTED FOR ELEMENTAL ANALYSES:** A total of 7 samples consisting of 3 species from one substrate (rock) were collected for elemental analyses. Analyses were performed on all seven samples using Proton Induced X-ray Emission (PIXE) techniques. Below is a list of the elemental analysis samples by sample number, species, substrate and collection site (the first number represents the storage drawer and the second number represents the specimen bag number). All specimens are stored in Hubco Cloth bags in the elemental analysis collection in the Herbarium of Nonvascular Cryptogams at Brigham Young University.

<u>Sample#</u>	<u>Taxa</u>	<u>Substr</u>	<u>Collection Site</u>
23-185	<i>Rhizoplaca melanophthalma</i>	Rock	Burnt Ridge Trail
23-186	<i>Xanthoparmelia cumberlandia</i>	Rock	Burnt Ridge Trail
23-187	<i>Rhizoplaca melanophthalma</i>	Rock	China Meadows
23-188	<i>Umbilicaria virginis</i>	Rock	Top of Burnt Ridge
23-189	<i>Rhizoplaca melanophthalma</i>	Rock	E. Fk Blacks Fk Basin
23-190	<i>Umbilicaria virginis</i>	Rock	Vicinity of Bald Mtn.
23-192	<i>Umbilicaria virginis</i>	Rock	Ailsop Lake Basin

### POLLUTION SENSITIVE INDICATOR SPECIES BY REFERENCE SITE:

#### Hole in the Rock Spring:

*Caloplaca holocarpa* (intermediate sensitivity to sulfur dioxide)  
*Letharia vulpina* (intermediate sensitivity to ozone)  
*Physcia dubia* (sensitive to intermediate sensitivity to fluoride)  
*Xanthoria fallax* (sensitive to intermediate sensitivity to sulfur dioxide)

#### Burnt Ridge Trail:

*Bryoria fuscescens* (intermediate sensitivity to sulfur dioxide)  
*Candelariella vitellina* (intermediate sensitivity to sulfur dioxide; sensitive to fluoride)  
*Cladonia fimbriata* (sensitive to intermediate sensitivity to sulfur dioxide)  
*Letharia vulpina* (intermediate sensitivity to ozone)  
*Melanelia subargentifera* (intermediate sensitivity to sulfur dioxide)  
*Parmeliopsis ambigua* (intermediate sensitivity to sulfur dioxide)

*Peltigera canina* (sensitive to intermediate sensitivity to ozone)  
*Phaeophyscia sciastra* (sensitive to ozone)  
*Physcia adscendens* (intermediate sensitivity to sulfur dioxide;  
    sensitive to fluoride)  
*Physcia caesia* (intermediate sensitivity to sulfur dioxide)  
*Physcia dubia* (sensitive to intermediate sensitivity to fluoride)  
*Physconia detersa* (intermediate sensitivity to sulfur dioxide)  
*Rhizocarpon geographicum* (sensitive to fluoride)  
*Rhizoplaca melanophthalma* (sensitive to sulfur dioxide)  
*Usnea hirta* (sensitive to intermediate sensitivity to sulfur  
    dioxide)  
*Xanthoparmelia cumberlandia* (sensitive to sulfur dioxide)  
*Xanthoria candelaria* (sensitive to ozone; intermediate  
    sensitivity to sulfur dioxide)  
*Xanthoria polycarpa* (intermediate sensitivity to sulfur dioxide)

#### **China Meadows:**

*Bryoria fuscescens* (intermediate sensitivity to sulfur dioxide)  
*Caloplaca holocarpa* (intermediate sensitivity to sulfur dioxide)  
*Candelariella vitellina* (intermediate sensitivity to sulfur  
    dioxide, sensitive to fluoride)  
*Cladonia fimbriata* (sensitive to intermediate sensitivity to  
    sulfur dioxide)  
*Lecanora saligna* (intermediate sensitivity to sulfur dioxide)  
*Melanelia exasperatula* (intermediate sensitivity to sulfur  
    dioxide)  
*Parmeliopsis ambigua* (intermediate sensitivity to sulfur  
    dioxide)  
*Parmeliopsis hyperopta* (intermediate sensitivity to sulfur  
    dioxide)  
*Physcia adscendens* (intermediate sensitivity to sulfur dioxide)  
*Physcia caesia* (intermediate sensitivity to sulfur dioxide)  
*Physcia dubia* (sensitive to intermediate sensitivity to fluoride)  
*Rhizocarpon geographicum* (sensitive to fluoride)  
*Rhizoplaca melanophthalma* (sensitive to sulfur dioxide)  
*Usnea subfloridana* (sensitive to intermediate sensitivity to  
    sulfur dioxide)  
*Xanthoparmelia cumberlandia* (sensitive to sulfur dioxide)  
*Xanthoria fallax* (sensitive to intermediate sensitivity to sulfur  
    dioxide)  
*Xanthoria polycarpa* (intermediate sensitivity to sulfur dioxide)

**East Fork of Blacks Fork Basin:**

*Bryoria fuscescens* (intermediate sensitivity to sulfur dioxide)  
*Caloplaca cerina* (sensitive to intermediate sensitivity to sulfur dioxide)  
*Candelariella vitellina* (intermediate sensitivity to sulfur dioxide, sensitive to fluoride)  
*Cladonia coniocraea* (intermediate sensitivity to sulfur dioxide)  
*Cladonia fimbriata* (sensitive to intermediate sensitivity to sulfur dioxide)  
*Letharia vulpina* (intermediate sensitivity to ozone)  
*Parmeliopsis ambigua* (intermediate sensitivity to sulfur dioxide)  
*Parmeliopsis hyperopta* (intermediate sensitivity to sulfur dioxide)  
*Physcia dubia* (sensitive to intermediate sensitivity to fluoride)  
*Rhizoplaca melanophthalma* (sensitive to sulfur dioxide)  
*Tuckermannopsis chlorophylla* (sensitive to sulfur dioxide)  
*Xanthoparmelia cumberlandia* (sensitive to sulfur dioxide)  
*Xanthoria fallax* (sensitive to intermediate sensitivity to sulfur dioxide)

**Vicinity of Bald Mountain:**

*Peltigera canina* (sensitive to intermediate sensitivity to ozone)  
*Pseudephebe minuscula* (intermediate sensitivity to ozone)  
*Rhizocarpon geographicum* (sensitive to fluoride)  
*Rhizoplaca melanophthalma* (sensitive to sulfur dioxide)

**Allsop Lake Basin:**

*Acarospora chlorophana* (sensitive to sulfur dioxide)  
*Candelariella vitellina* (intermediate sensitivity to sulfur dioxide, sensitive to fluoride)  
*Cladonia fimbriata* (sensitive to intermediate sensitivity to sulfur dioxide)  
*Phaeophyscia orbicularis* (sensitive to ozone, fluoride, intermediate sensitivity to sulfur dioxide)  
*Physcia caesia* (intermediate sensitivity to sulfur dioxide)  
*Xanthoparmelia cumberlandia* (sensitive to sulfur dioxide)

**CHECKLIST OF LICHEN SPECIES FROM SELECTED SITES IN THE  
HIGH UNTAS WILDERNESS AREA, WASATCH-CACHE  
NATIONAL FOREST, UTAH**

**Acarospora chlorophana (Wahlenb. ex Ach.) Massal.**

Growth form: Crustose with effigurate margins

Substrate: Rock, usually vertical surfaces

Site(s): Allsop Lake Basin

Relative abundance: Locally abundant

Pollution sensitivity: Sensitive to sulfur dioxide (Hale 1982)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22767

**Acarospora fuscata (Nyl.) Arnold**

Growth form: Crustose

Substrate: Rock

Site(s): China Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22628, BRY C-22686

**Acarospora schleicheri (Ach.) Mass.**

Growth form: Crustose

Substrate: Soil

Site(s): Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This lichen occurs on both rock and soil substrates; however, in our collections from the High Uintas Wilderness Area it was collected only from the soil in alpine tundra habitats.

Deposition of specimens: BYU Herbarium: BRY C22612, BRY C-22687

*Acarospora smaragdula* (Wahlenb. in Ach.) Massal.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium BRY C22565

*Agrestia hispida* (Mereschk.) Hale & Culb.

Growth form: Fruticose

Substrate: Vagrant on soil

Site(s): Hole in the Rock Spring

Relative abundance: Locally common

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C-21867

*Arthonia glebosa* Tuck.

Growth form: Crustose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1031, BRY C22620

*Aspicilia aquatica* Körber.

Growth form: Crustose

Substrate: Rock

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22768

*Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arnold.

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 477

*Aspicilia calcarea* (L.) Mudd

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Common

Pollution sensitivity: Unknown

Comments: This species is not clearly defined and probably represents a "catch all" group of related, but poorly known species.

Deposition of Specimens: BYU Herbarium: BRY C22567

*Aspicilia reptans* (Looman) Wetm.

Growth form: Fruticose

Substrate: Soil (vagrant)

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species fits into a group of vagrant (unattached) species which are commonly found in *Artemisia* sp. shrublands at much lower elevations. However, this particular species often occurs at higher elevations, but is reported here for the first time from true alpine tundra. This species is a new state record.

Deposition of Specimens: BYU Herbarium: BRY C21863

*Bacidia carneoalbida* (Müll. Arg.) Coppins.

Growth form: Crustose

Substrate: Moss

Site(s): Hole In The Rock Spring

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 923

*Bellemerea alpina* (Sommerf.) Clauz. & Roux

Growth form: Crustose

Substrate: Rock

Site(s): China Meadows

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22650

*Brodoa oroarctica* (Krog) Goward

Growth form: Foliose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22578

*Bryonora castanea* (Hepp) Poelt.

Growth form: Crustose

Substrate: Moss

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species is a new state record

Deposition of specimens: BYU Herbarium: CN 2502

*Bryoria fuscescens* (Gyelnik) Brodo & D. Hawksw.

Growth form: Fruticose

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin, China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide (Wetmore 1987)

Comments: This species is a new record for Utah.

Deposition of specimens: BYU Herbarium: CN 1059, BRY C22629, BRY C-22688

*Buellia erubescens* Arnold.

Growth form: Crustose

Substrate: Lignum

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1091

*Buellia papillata* (Sommerf.) Tuck.

Growth form: Crustose

Substrate: Moss, soil, detritus

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1351

*Buellia punctata* (Hoffm.) Massal.

Growth form: Crustose

Substrate: Lignum, bark, rock

Site(s): Allsop Lake Basin, Hole In The Rock Spring

Relative abundance: Rare to locally common

Pollution sensitivity: Tolerant of sulfur dioxide (Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: CN 924

*Caloplaca arenaria* (Pers.) Müll. Arg.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22568

*Caloplaca arizonica* Magnusson

Growth form: Crustose

Substrate: Lignum, bark

Site(s): Hole In The Rock Spring

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 919

*Caloplaca cerina* (Ehrh. ex Hedwig) Th. Fr.

Growth form: Crustose

Substrate: Moss, humic soil

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987).

Comments: None

Deposition of specimens: BYU Herbarium: CN 1131

*Caloplaca cinnabarina* (Ach.) Zahlbr.

Growth form: Crustose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22689

*Caloplaca cladodes* (Tuck.) Zahlbr.

Growth form: Crustose, minutely fruticose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1107

Caloplaca epithallina Lyng

Growth form: Crustose

Substrate: Rock (epiphytic on other saxicolous lichen species)

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22569, BRY C22631, BRY C-22691

Caloplaca ferruginea (Huds.) Th. Fr.

Growth form: Crustose

Substrate: Bark

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22769

Caloplaca fraudans (Th. Fr.) H. Olivier.

Growth form: Crustose (thallus scant)

Substrate: Lignum, rock

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1093, BRY C-22690

Caloplaca holocarpa (Hoffm.) Wade.

Growth form: Crustose

Substrate: Lignum, bark

Site(s): Hole In The Rock Spring, China Meadows

Relative abundance: Rare

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide (Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: CN 818, BRY C22630

*Caloplaca jungermanniae* (Vahl) Th. Fr.

Growth form: Crustose

Substrate: Moss

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 857, BRY C22621

*Caloplaca livida* (Hepp) Jatta

Growth form: Crustose

Substrate: Moss

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1133

*Caloplaca tiroiensis* Zahlbr.

Growth form: Crustose

Substrate: Vascular plant detritus

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22570

*Caloplaca trachyphylla* (Tuck.) Zahlbr.

Growth form: Crustose with distinctly lobed margins

Substrate: Rock

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22770

*Candelariella aurella* (Hoffm.) Zahlbr.

Growth form: Crustose

Substrate: Vascular plant detritus

Site(s): Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22571

*Candelariella deflexa* (Nyl.) Zahlbr.

Growth form: Crustose, obsolete

Substrate: Lignum

Site(s): China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22633, BRY C-22694

*Candelariella placodizans* (Nyl.) Magnusson

Growth form: Crustose

Substrate: Soil

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22771

*Candelariella rosulans* (Müll. Arg.) Zahlbr.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22572

*Candelariella terrigena* Räsänen

Growth form: Crustose

Substrate: Soil

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 598

*Candelariella vitellina* (Hoffm.) Müll. Arg.

Growth form: Crustose

Substrate: Lignum, bark, moss, humus, soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, China

Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide  
(Wetmore 1987); sensitive to fluoride (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 962, BRY C22632,  
BRY C-22692, BRY C-22693

*Candelariella xanthostigma* (Ach.) Lettau

Growth form: Crustose

Substrate: Moss, detritus, decayed lignum, bark

Site(s): Allsop Lake Basin, East Fork Blacks Forks Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1050

*Catapyrenium cinereum* (Pers.) Körber.

Growth form: Crustose to squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain, China

Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 694, BRY C22622,  
BRY C22634, BRY C-22695

*Catapyrenium daedaleum* (Krempelh.) B. Stein

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record

Deposition of specimens: BYU Herbarium: CN 741

*Catapyrenium lachneum* (Ach.) R. Sant.

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 847, BRY C22623, BRY C-22696

*Catapyrenium tuckermanii* (Rav. ex Mont.) Thompson

Growth form: Squamulose

Substrate: Bark

Site(s): Hole In The Rock Spring

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 704

*Cetraria ericetorum* Opiz

Growth form: Foliose

Substrate: Soil (vagrant)

Site(s): Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22573

*Cetraria tilesii* Ach.

Growth form: Foliose

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22574

*Cladonia bacillaris* Nyl. (Santesson 1984)

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22772

*Cladonia cariosa* (Ach.) Sprengel

Growth form: Squamulose with podetia

Substrate: Soil, humic soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, China  
Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 611, BRY C 22637  
BRY C-22699

*Cladonia chlorophaea* (Flörke ex Sommerf.) Sprengel

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): East Fork of Blacks Fork Basin, Burnt Ridge

Relative abundance: Common to locally abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22698

*Cladonia coniocraea* auct. (fide Ahti)

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): East Fork of Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Intermediately sensitive to sulfur dioxide (Wetmore 1987).

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22773

*Cladonia fimbriata* (L.) Fr.

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, China Meadows, Burnt Ridge

Relative abundance: Locally common to abundant

Pollution sensitivity: Sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987).

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22636, BRY C-22738

*Cladonia macrophyllodes* Nyl.

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: BRY C-22774

*Cladonia pocillum* (Ach.) O. Rich

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, China Meadows,

Relative abundance: Common to locally abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1177, BRY C22638,

*Cladonia polydactyla* (Flörke) Sprengel

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: BRY C-22775

*Cladonia pyxidata* (L.) Hoffm.

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Vicinity  
of Bald Mountain, China Medows

Relative abundance: Common to abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 632,  
BRY C22613, BRY C22635

*Cladonia sulphurina* (Michaux) Fr.

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): Allsop Lake Basin

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 927

*Cladonia umbricola* Tønsb. & Ahti

Growth form: Squamulose with podetia

Substrate: Humic soil, decomposing lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: BRY C-22776

*Coelocaulon aculeatum* (Schreber) Link

Growth form: Fruticose

Substrate: Soil (vagrant)

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22575

*Collema cristatum* (L.) Weber ex Wigg.

Growth form: Foliose

Substrate: Rock (limestone)

Site(s): China Meadows

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22639

*Dactylinia madreporeiformis* (Ach.) Tuck.

Growth form: Fruticose

Substrate: Soil

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 745, BRY C22624

*Dermatocarpon miniatum* (L.) Mann

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Hole In The Rock Spring, China Meadows

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 693, BRY C22614, BRY C22640

*Dermatocarpon reticulatum* Magnusson

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Hole In The Rock Spring

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22777

*Dimelaena oreina* (Ach.) Norman

Growth form: Crustose with effigurate margin

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22576, BRY C22641, BRY C-22700

*Diploschistes muscorum* (Scop.) R. Sant.

Growth form: Crustose

Substrate: Soil

Site(s): Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of species: BYU Herbarium: BRY C22615, BRY C-22701

*Evernia divaricata* (L.) Ach.

Growth form: Fruticose

Substrate: Soil, bark

Site(s): Allsop Lake Basin, vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 744, BRY C22625

*Fulgenisa bracteata* (Hoffm.) Räs.

Growth form: Crustose with effigurate margins  
Substrate: Soil  
Site(s): Vicinity of Bald Mountain  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of Specimens: BYU Herbarium: BRY C22577

*Glypholechia scabra* (Pers.) Müll. Arg.

Growth form: Foliose, umbilicate  
Substrate: Rock  
Site(s): Hole In The Rock Spring  
Relative abundance: Rare to locally common  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: CN 743

*Hypogymnia bitteri* (Lyngé) Ahti

Growth form: Foliose  
Substrate: Lignum  
Site(s): East Fork Blacks Fork Basin  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: This species is a new state record.  
Deposition of specimens: BYU Herbarium: BRY C21696

*Japewia tornoensis* (Nyl.) Tønsberg

Growth form: Crustose  
Substrate: Lignum  
Site(s): Hole In The Rock Spring  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: BRY C-22778

*Lecanora argopholis* (Ach.) Ach.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22583, BRY C22642, BRY C-22702

*Lecanora bicincta* Ramond

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22580

*Lecanora cenisia* Ach.

Growth form: Crustose, areolate

Substrate: Rock, lignum, conifer bark

Site(s): China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22646, BRY C-22703, BRY C-22704, BRY C-22705

*Lecanora epibryon* (Ach.) Ach.

Growth form: Crustose

Substrate: Moss, detritus

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22582

*Lecanora hagenii* (Ach.) Ach.

Growth form: Crustose, thallus scant to absent

Substrate: Lignum, detritus

Site(s): Hole In The Rock Spring, Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 841, BRY C22626

*Lecanora mughicola* Nyl.

Growth form: Crustose, thallus scant

Substrate: Lignum

Site(s): China Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22648, BRY C-22706

*Lecanora novomexicana* (B. de Lesd.) Zahlbr.

Growth form: Crustose with effigurate margins

Substrate: Rock

Site(s): East Fork Blacks Fork Basin, Hole In The Rock Spring, China Meadows, Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Common to locally abundant

Pollution sensitivity: Unknown

Comments: At high elevation sites this is one of the more common saxicolous species.

Deposition of specimens: BYU Herbarium: CN 840, BRY C22644, BRY C22587, BRY C-22707

*Lecanora polytropa* (Hoffm.) Rahbenn.

Growth form: Crustose, thallus scant to absent

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22585, BRY C22645, BRY C-22708

*Lecanora rupicola* (L.) Zahlbr.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22586, BRY C22643, BRY C-22709

*Lecanora saligna* (Schrader) Zahlbr.

Growth form: Crustose

Substrate: Lignum

Site(s): China Meadows

Relative abundance: Rare to locally common

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide  
(Wetmore 1987)

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22647

*Lecanora thallopila* Magnusson

Growth form: Crustose

Substrate: Epiphytic on *Dermtaocarpon* sp.

Site(s): Allsop Lake Basin, Hole In The Rock Spring

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1216

*Lecanora varia* (Hoffm.) Ach.

Growth form: Crustose, thallus scant

Substrate: Lignum, bark

Site(s): China Meadows. Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22649, BRY C-22710

*Lecidea atrobrunnea* (Raymond *in* Lam. & DC.) Schaefer

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Common to abundant

Pollution sensitivity: Tolerant of sulfur dioxide (Ryan 1990)

Comments: This genus (*Lecidea*) is in desperate need of revision. *L. atrobrunnea* shows a great deal of variability in thallus color, which may in some cases be related to habitat factors, especially light intensity.

Deposition of specimens: BYU Herbarium: CN 1307, BRY C22627, BRY C22651, BRY C-22711

*Lecidea auriculata* Th. Fr.

Growth form: Crustose, thallus scant to absent

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22589

*Lecidea coloradoensis* Anderson *in* ed

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 729

*Lecidea extenuata* Vainio

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 751

*Lecidea marginata* Schaeerer

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22593

*Lecidea tessellata* Flörke

Growth form: Crustose, thallus scant to obsolete

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22594, BRY C22652, BRY C-22712

*Lecidea turgidula* Fr.

Growth form: Crustose

Substrate: Lignum

Site(s): Allsop Lake Basin, Hole In The Rock Spring

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 2500

*Lecidella euphorea* (Flörke) Hertel

Growth form: Crustose

Substrate: Lignum, bark

Site(s): Hole In The Rock Spring, China Meadows

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 902, BRY C22653

*Lecidella stigmata* (Ach.) Hertel & Leuck

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22779

*Leproloma membranaceum* (Dickson) Vainio

Growth form: Crustose/leprose

Substrate: Moss, rock, other lichens

Site(s): East Fork Blacks Fork Basin, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22714

*Leproloma vousauxii* (Hue) Laundon

Growth form: Crustose/leprose

Substrate: Soil

Site(s): Allsop Lake Basin, vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22595, BRY C-22713

*Letharia vulpina* (L.) Hue

Growth form: Fruticose

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin, Hole In The Rock Spring, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Tolerant of sulfur dioxide (Ryan 1990); tolerant to intermediate sensitivity to ozone (Ryan 1990).

Comments: None

Deposition of specimens: BYU Herbarium: CN 1032, 1033, BRY C-22715

**Megaspera verrucosa** (Ach.) Hafellner & V. Wirth

Growth form: Crustose

Substrate: Lignum, moss, bark, detritus

Site(s): Allsop Lake Basin, Hole In The Rock Spring, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1252, BRY C-22716, BRY C-22717

**Melanelia elegantula** (Zahlbr.) Essl.

Growth form: Foliose

Substrate: Lignum, bark, moss, rarely on shaded rocks

Site(s): Hole In The Rock Spring, China Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Tolerant of ozone (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1449, BRY C22656 BRY C22657, BRY C-22718, BRY C-22719, BRY C-22720, BRY C-22721, BRY C-22722

**Melanelia exasperatula** (Nyl.) Essl.

Growth form: Foliose

Substrate: Moss, bark (spruce twigs), lignum

Site(s): China Meadows

Relative abundance: Rare to locally common

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22658, BRY C22659, BRY C22660

**Melanelia soreciata** (Ach.) Goward & Ahti

Growth form: Foliose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22723

*Melanelia subargentifera* (Nyl.) Essl.

Growth form: Foliose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide  
(Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22724

*Melanelia subelegantula* (Essl.) Essl.

Growth form: Foliose

Substrate: Bark, lignum

Site(s): East Fork Blacks Fork Basin, China Meadows

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1488, BRY  
C22654

*Melanelia subolivacea* (Nyl. in Hasse) Essl.

Growth form: Foliose

Substrate: Spruce bark and twigs

Site(s): China Meadows

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY  
C22655

*Melanelia substygia* (Räsänen) Essl.

Growth form: Foliose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22597, BRY C-  
22725

*Mycobilimbia berengeriana* (Massal.) Hafellner & V. Wirth

Growth form: Crustose

Substrate: Humic soil/detritus, conifer duff

Site(s): Vicinity of Bald Mountain, Allsop Lake Basin, China  
Meadows

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: CN 1345, BRY  
C22590, BRY C22663

*Mycocalicium subtile* (Pers.) Szat.

Growth form: Crustose, thallus scant to absent

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is non-lichenized; however, because  
it is traditionally grouped with the lichens it is included  
in our list for the High Uintas Wilderness Area.

Deposition of specimens: BYU Herbarium: CN 1353

*Ochrolechia upsaliensis* (L.) Massal.

Growth form: Crustose

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C21866

*Pannaria pezizoides* (Weber) Trevisan

Growth form: Squamulose

Substrate: Conifer duff, humic soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species is commonly collected along  
trails in coniferous forests.

Deposition of specimens: BYU Herbarium: CN 860

Pannaria praetermissa Nyl. in Chyd. & Furuhj.

Growth form: Crustose/squamulose

Substrate: Moss, humus

Site(s): Allsop Lake Basin, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: CN 1332, BRY C-22726

Parmeliopsis ambigua (Wulfen in Jacq.) Nyl.

Growth form: Foliose

Substrate: Bark, lignum

Site(s): East Fork Blacks Fork Basin, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide (Wetmore 1987); Tolerant of fluoride (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1388, BRY C22661, BRY C-22727

Parmeliopsis hyperopta ((Ach.) Arnold

Growth form: Foliose

Substrate: Bark, lignum

Site(s): East Fork Blacks Fork Basin, China Meadows

Relative abundance: Rare

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide (Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1392, BRY C22662

Peltigera aphosa var. leucophlebia (L.) Wilde

Growth form: Foliose

Substrate: Soil, conifer duff

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1459, BRY C22617, BRY C-22729

*Peltigera canina* (L.) Willd.

Growth forth: Foliose

Substrate: Soil

Site(s): Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: None

Deposition of species: BYU Herbarium: BRY C22618, BRY C-22728

*Peltigera didactyla* (With.) Laundon

Growth form: Foliose

Substrate: Decomposing lignum, moss, soil

Site(s): Allsop Lake Basin, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22730

*Peltigera rufescens* (Weis.) Humb.

Growth form: Foliose

Substrate: Soil

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22599, BRY C22664, BRY C-22731

*Peltigera venosa* (L.) Hoffm.

Growth form: Foliose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species commonly occurs along trails in moist shaded habitats.

Deposition of specimens: BYU Herbarium: CN 1453, BRY C22619, BRY C-22737

*Phaeophyscia endococcina* (Körber) Moberg

Growth form: Foliose

Substrate: Bark, rock

Site(s): Allsop Lake Basin, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1509, BRY C-22732

*Phaeophyscia nigricans* (Flörke) Moberg

Growth form: Foliose

Substrate: Rock

Site(s): China Meadows

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22665

*Phaeophyscia orbicularis* (Necker) Moberg

Growth form: Foliose

Substrate: Bark

Site(s): Allsop Lake Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Sensitive to ozone and fluoride and  
intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 868

*Phaeophyscia sciastra* (Ach.) Moberg

Growth form: Foliose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Sensitive to ozone (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22733

*Phaeorrhiza nimbosa* (Fr.) Mayrh. & Poelt

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Hole In The Rock Spring, vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1440, BRY C22603

*Phaeorrhiza sareptana* (Tomin) Mayrh. & Poelt

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1386

*Physcia adscendens* (Fr.) H. Olivier

Growth form: Foliose

Substrate: Bark (spruce twigs), Quaking Aspen bark

Site(s): China Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Intermediate sensitivity to sulfur dioxide, sensitive to fluoride (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22666, BRY C-22734

*Physcia biziana* (Massal.) Zahlbr.

Growth form: Foliose

Substrate: Bark, rock

Site(s): Hole In The Rock Spring, China Meadows, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 941, BRY C22670, BRY C-22739

*Physcia caesia* (Hoffm.) Fürnr.

Growth form: Foliose

Substrate: Rock, over other lichens on rock

Site(s): Allsop Lake Basin, China Meadows, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Intermediately sensitive to sulfur dioxide  
(Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1526, BRY

C22669, BRY C-22735, BRY C-22736

*Physcia dubia* (Hoffm.) Lettau

Growth form: Foliose

Substrate: Lignum, bark, rock, moss over rock

Site(s): East Fork Blacks Fork Basin, Hole In The Rock Spring,  
China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Tolerant of sulfur dioxide; sensitive to  
intermediately sensitive to fluoride (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1538, BRY

C22667, BRY C22668, BRY C-22740

*Physconia detersa* (Nyl.) Poelt

Growth form: Foliose

Substrate: Moss, rock

Site(s): Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Intermediately sensitive to sulfur dioxide  
(Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22742, BRY C-

22743

*Physconia muscigena* (Ach.) Poelt

Growth form: Foliose

Substrate: Moss, soil

Site(s): Allsop Lake Basin, vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1547, BRY C22600, BRY C-22741

*Placynthiella uliginosa* (Schrader) Coppins & P. James

Growth form: Crustose

Substrate: Lignum, bark, conifer duff, humic soil

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1361

*Polychidium muscicola* (Schwartz) Grey

Growth form: Minutely fruticose

Substrate: Moss

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1396

*Protoblastenia rupestris* (Scop.) Steiner

Growth form: Crustose, thallus scant to absent

Substrate: Calcareous rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 882

Protoparmelia badia (Hoffm.) Hafellner

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22579, BRY C-22744

Pseudephebe minuscula (Nyl. in Arnold) Brodo & D. Hawksw.

Growth form: Minutely fruticose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Intermediately sensitive to ozone (Ryan 1990)

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22566

Pseudephebe pubescens (L.) M. Choisy

Growth form: Fruticose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 750

Psora decipiens (Hedwig) Hoffm.

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22591

*Psora globifera* Ach.

Growth form: Squamulose

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of species: BYU Herbarium: BRY C22616

*Psora luridella* (Tuck.) Fink

Growth form: Squamulose

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22592

*Psora montana* Timdal

Growth form: Squamulose

Substrate: Soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22745

*Psoroma hypnorum* (Vahl) Grey

Growth form: Squamulose

Substrate: Moss, humic soil

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 860, BRY C22671, BRY C-22746

*Psoroma tenue* var. *boreale* Henssen

Growth form: Squamulose

Substrate: Soil

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1360

*Rhizocarpon disporum* (Naeg. ex Hepp) Müll. Arg.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Common to locally abundant

Pollution sensitivity: Unknown

Comments: This species is often associated with late snow melt areas at high elevation sites

Deposition of Specimens: BYU Herbarium: BRY C22601, BRY C22674, BRY C-22747

*Rhizocarpon geminatum* Körber

Growth form: Crustose

Substrate: Rock

Site(s): China Meadows

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22673

*Rhizocarpon geographicum* (L.) DC.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Common to locally abundant

Pollution sensitivity: Tolerant of sulfur dioxide; sensitive to fluoride (Ryan 1990)

Comments: This species is one of the most commonly collected saxicolous lichens in the higher elevation sites of the High Uintas Wilderness Area.

Deposition of Specimens: BYU Herbarium: BRY C22602, BRY C22672, BRY C-22748

*Rhizocarpon simillimum* (Anzi) Lettau

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 733

*Rhizocarpon superficiale* (Schaerer) Vainio

Growth form: Crustose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22749

*Rhizoplaca chysoleuca* (Sm.) Zopf.

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Vicinity of Bald Mountain, China Meadows, Burnt Ridge,  
Hole in the Rock Spring

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22581, BRY  
C22675, BRY C-22750, BRY C-22751, BRY C-21868

*Rhizoplaca melanophthalma* (DC in Lam. & DC)

Growth form: Foliose, umbilicate

Substrate: Rock, rarely on lignum

Site(s): East Fork Blacks Fork Basin, vicinity of Bald Mountain,  
China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Sensitive to sulfur dioxide (Hale 1982)

Comments: Material of this species was collected for elemental  
analysis at the East Fork of Blacks Fork, Burnt Ridge and  
China Meadows.

Deposition of specimens: BYU Herbarium: BRY C22584, BRY  
C22676, BRY C-22752

*Rhizoplaca subdiscrepans* (Nyl.) R. Sant.

Growth form: Crustose or indistinctly umbilicate  
Substrate: Rock  
Site(s): China Meadows  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: BRY C22677

*Rinodina glauca* (Magn.) Ropin ined.

Growth form: Crustose  
Substrate: Lignum  
Site(s): East Fork Blacks Fork Basin  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: CN 1433

*Rinodina lignicola* Sheard

Growth form: Crustose  
Substrate: Lignum  
Site(s): East Fork of Blacks Fork  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: BRY C-22780

*Rinodina mniarea* (Ach.) Körber

Growth form: Crustose  
Substrate: Moss  
Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, Burnt Ridge  
Relative abundance: Rare  
Pollution sensitivity: Unknown  
Comments: None  
Deposition of specimens: BYU Herbarium: CN 1431, BRY C-22753

*Solorina bispora* Nyl.

Growth form: Foliose

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22604

*Solorina spongiosa* (Ach.) Anzi

Growth form: Foliose

Substrate: Moist soil

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 764

*Sporastatia polyspora* (Nyl.) Grumm.

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22605

*Sporastatia testudinea* (Ach.) Massal.

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin, Vicinity of Bald Mountain, China

Meadows, Burnt Ridge

Relative abundance: Common to abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 658, BRY C22606,  
BRY C22678, BRY C-22754

*Staurothele areolata*

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 749

*Staurothele drummondii* (Tuck.) Tuck.

Growth form: Crustose

Substrate: Rock (limestone)

Site(s): China Meadows

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of species: BYU Herbarium: BRY C22607

*Staurothele fissa* (Taylor) Zwackh

Growth form: Crustose

Substrate: Rock

Site(s): Allsop Lake Basin

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22781

*Stereocaulon glareosum* (Savicz) Magnusson

Growth form: Fruticose

Substrate: Soil

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1405

*Teloschistes contortuplicatus* (Ach.) Clauz. & Rondon ex Vezda

Growth form: Foliose

Substrate: Rock, Rarely Lignum

Site(s): Hole In The Rock Spring

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 942

*Tephromela armeniaca* (DC.) Hertel & Rambold

Growth form: Crustose

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22588

*Thrombium epigaeum* (Pers.) Wallr.

Growth form: Crustose

Substrate: Soil

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1056

*Toninia caeruleonigricans* (Lightf.) Th. Fr.

Growth form: Crustose-verrucose

Substrate: Soil, soil over rock

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1329

*Toninia ruginosa* (Tuck.) Herre

Growth form: Crustose-verrucose

Substrate: Soil

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 730

*Tuckermannopsis chlorophylla* (Willd. *in* Humb.) Hale

Growth form: Foliose

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Sensitive to sulfur dioxide (Ryan 1990)

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: BRY C21697

*Umbilicaria decussata* (Vill.) Zahlbr.

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): East Fork of Blacks Fork Basin, vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22608

*Umbilicaria hyperborea* (Ach.) Hoffm.

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22756

*Umbilicaria krascheninnikovii* (Sav.) Zahlbr.

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Vicinity of Bald Mountain

Relative abundance: Locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of Specimens: BYU Herbarium: BRY C22609

*Umbilicaria virginis* Schaeerer

Growth form: Foliose, umbilicate

Substrate: Rock

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, vicinity of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Locally common to abundant

Pollution sensitivity: Unknown

Comments: Material of this species was collected for elemental analyses at Burnt Ridge, vicinity of Bald Mountain and Allsop Lake Basin

Deposition of specimens: BYU Herbarium: CN 792, BRY C22610, BRY C22679, BRY C-22755

*Usnea hirta* (L.) Weber ex Wigg.

Growth form: Fruticose

Substrate: Bark, lignum

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22757, BRY C-22758

*Usnea subfloridana* Stirton

Growth form: Fruticose

Substrate: Bark, lignum

Site(s): China Meadows

Relative abundance: Rare

Pollution sensitivity: Sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22680

*Verrucaria aethiobola* Wahlenb. *in* Ach.

Growth form: Crustose

Substrate: On submerged rock in subalpine stream.

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: BRY C-22782

*Xanthoparmelia chlorochroa* (Tuck.) Hale

Growth form: Foliose (vagrant)

Substrate: Soil

Site(s): Vicinity of Bald Mountain

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: This species typically occurs at a much lower elevation. We suspect it may have been transported to this site by domestic sheep.

Deposition of Specimens: BYU Herbarium: BRY C21865

*Xanthoparmelia cumberlandia* (Gyelnik) Hale

Growth form: Foliose

Substrate: Rock, moss over rock

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin,  
Burnt Ridge Trail, China Meadows

Relative abundance: Common

Pollution sensitivity: Sensitive to sulfur dioxide (Ryan 1990)

Comments: This species was collected for elemental analyses along Burnt Ridge Trail.

Deposition of specimens: BYU Herbarium: BRY C22681, BRY C-22759, BRY C-22760

*Xanthoparmelia plittii* (Gyelnik *ex* D. Dietr.) Hale

Growth form: Foliose

Substrate: Rock

Site(s): Burnt Ridge

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22761

*Xanthoria candelaria* (L.) Th.Fr.

Growth form: Minutely foliose

Substrate: Lignum, bark

Site(s): East Fork Blacks Fork Basin, Burnt Ridge

Relative abundance: Rare to locally common

Pollution sensitivity: Sensitive to ozone (Ryan 1990),  
intermediately sensitive to sulfur dioxide (Wetmore  
1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C-22762

*Xanthoria elegans* (Link) Th. Fr.

Growth form: Minutely foliose

Substrate: Rock

Site(s): Allsop Lake Basin, East Fork Blacks Fork Basin, vicinity  
of Bald Mountain, China Meadows, Burnt Ridge

Relative abundance: Common to abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1150, BRY  
C22611, BRY C22682, BRy C-22763

*Xanthoria elegans* var. *splendens* (Darbish.) Christ. ex Poelt

Growth form: Minutely foliose

Substrate: Humus

Site(s): Allsop Lake Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 650

*Xanthoria fallax* (Hepp in Arnold) Arnold

Growth form: Foliose

Substrate: Lignum, bark, rare on rock

Site(s): East Fork Blacks Fork Basin, Hole In The Rock Spring,  
China Meadows

Relative abundance: Locally common

Pollution sensitivity: Tolerant of ozone, sensitive to  
intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: None

Deposition of specimens: BYU Herbarium: CN 1152, BRY  
C22684

*Xanthoria polycarpa* (Hoffm.) Rieber

Growth form: Minutely foliose

Substrate: Lignum, bark

Site(s): China Meadows, Burnt Ridge

Relative abundance: Locally common

Pollution sensitivity: Intermediately sensitive to sulfur dioxide  
(Wetmore 1987)

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22598, BRY C-22764, BRY C-22765

*Xanthoria sorediata* (Vainio) Poelt

Growth form: Minutely foliose

Substrate: Rock

Site(s): China Meadows, Burnt Ridge

Relative abundance: Common to abundant

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: BRY C22683, BRY C-22766

*Xylographa abietina* (Pers.) Zahlbr.

Growth form: Crustose

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare to locally common

Pollution sensitivity: Unknown

Comments: None

Deposition of specimens: BYU Herbarium: CN 1058

*Xylographa hians* Tuck.

Growth form: Crustose

Substrate: Lignum

Site(s): East Fork Blacks Fork Basin

Relative abundance: Rare

Pollution sensitivity: Unknown

Comments: This species is a new state record.

Deposition of specimens: BYU Herbarium: CN 1038

Xylographa juniperina St. Clair & Newberry ined

Growth form: Crustose

Substrate: Lignum

Site(s): Hole In The Rock Spring, China Meadows

Relative abundance: Rare to locally abundant

Pollution sensitivity: Unknown

Comments: This appears to be a new species.

Deposition of specimens: BYU Herbarium: CN 2503, BRY

C22685

**OBSERVATIONS AND CONCLUSIONS:**

1. The lichen flora of the High Uintas Wilderness Area is diverse and well developed. From our collections we have identified a total of 179 species in 43 genera. These numbers compare favorably with the results of Clayton Newberry's lichen flora of the Uinta Mountain Range (271 species in 95 genera). All growth forms are well represented; however, the flora is dominated by crustose species (50%, 90 species). This is not an unusual pattern for the Rocky Mountains. Foliose lichens comprise 29% (52 species) of the flora with squamulose species constituting 14% (24 species) and fruticose species 7% (13 species).
2. During this study lichens were collected from 5 basic substrates: rocks, lignum/bark, moss/detritus, soil and the thalli of other lichen species. Rock was the single most important substrate in this study. A total of 67 species (37% of the flora) were collected from various rock substrates. Terricolous substrates (soil) were second in importance accounting for 51 species (29% of the flora). Forty-one species (23% of the flora) were collected from various corticolous substrates (bark and lignum) with 18 species (10% of the flora) growing over various bryophyte species or plant detritus. Finally, 2 species (1% of the flora) occurred as epiphytes on other lichen species.
3. High species diversity, abundance of all growth forms and the significant occurrence of several pollution sensitive species indicates that the lichen communities are generally healthy and for the most part not impacted by air pollutants.

4. The general absence of necrotic and/or bleached thalli also suggests that the lichen flora has not been particularly impacted by air pollution.
5. Baseline concentrations of potential pollutant elements were evaluated in 3 different species of lichens collected from five of the reference sites. Specifically, *Rhizoplaca melanophthalma*, *Umbilicaria virginis* and *Xanthoparmelia cumberlandia* were analyzed for pollutant accumulation. Elemental analysis data are contained in Table 1. Figure 2 provides both background and elevated concentrations for several of the pollutant elements evaluated in this study.
6. Generally, sulfur concentrations above .20% in sensitive indicator species indicates significant potential for sulfur-related damage to lichen communities. Two of our elemental analysis samples (*Umbilicaria virginis* from Burnt Ridge and vicinity of Bald Mountain) showed potentially damaging sulfur levels (.21 and .20 % respectively). A third sample of the same species from Allsop Lake Basin also showed somewhat elevated sulfur values (.16 %). Sulfur values for the other samples, *Rhizoplaca melanophthalma* and *Xanthoparmelia cumberlandia* from Burnt Ridge Trail, China Meadows and East Fork of Blacks Fork, were well within acceptable levels. Copper values were particularly high in three of our samples. *Rhizoplaca melanophthalma* collected along Burnt Ridge Trail and at China Meadows each averaging 400 ppm; while *Umbilicaria virginis* samples collected at the Bald Mountain site averaged 1100 ppm. Concentrations of nickel, chromium and arsenic were also consistently high in several of our samples. This pattern of heavy metal accumulation is remarkably similar to elemental analysis data obtained from sensitive indicator species west of the now defunct Anaconda Copper Smelter in Montana (St. Clair and Newberry 1994). In the future levels of sulfur, copper, arsenic, chromium and nickel should be monitored carefully. Elevated pollutant concentrations are likely due to air pollutants transported into the area from the Wasatch Front.

#### **RECOMMENDATIONS:**

1. Eventually additional reference sites should be established in other parts of the wilderness area. Primarily, additional information about pollutant concentrations, especially sulfur

Table 1. Mean concentrations of potential pollutant elements in sensitive indicators species from air quality biomonitoring reference sites in the High Uinta Wilderness Area (Wasatch-Cache National Forest).

	Elements (ppm except where indicated)							
	S%	Cl	K%	Ca%	Ti	V	Cr	Mn
<i>Rhizoplaca melanophthalma</i> , (Burnt Ridge Trail)	.087	33	.36	1.60	330	nd*	nd	65
<i>Xanthoparmelia cumberlandia</i> (Burnt Ridge Trail)	.110	200	.74	3.45	620	nd	10	160
<i>Rhizoplaca melanophthalma</i> (China Meadows)	.100	nd	.39	1.34	250	nd	13	37
<i>Umbilicaria virginis</i> (Burnt Ridge)	.210	nd	.37	.076	200	nd	nd	28
<i>Rhizoplaca melanophthalma</i> (East Fork of Blacks Fork)	.084	nd	.45	5.0	410	nd	8	50
<i>Umbilicaria virginis</i> (Vicinity of Bald Mountain)	.200	190	.50	.124	360	nd	18	38
<i>Umbilicaria virginis</i> (Allsop Lake Basin)	.160	nd	.39	.072	150	nd	nd	28

**Table 1** cont. Mean concentrations of potential pollutant elements in sensitive indicators species from air quality biomonitoring reference sites in the High Uinta Wilderness Area (Wasatch- Cache National Forest).

	Elements (ppm except where indicated)							
	Fe	Co	Ni	Cu	Zn	Pb	As	Se
<i>Rhizoplaca melanophthalma</i> , (Burnt Ridge Trail)	2300	nd	110	400	250	36	nd	nd
<i>Xanthoparmelia cumberlandia</i> (Burnt Ridge Trail)	4000	nd	6	23	49	28	4	nd
<i>Rhizoplaca melanophthalma</i> (China Meadows)	1900	nd	34	400	210	34	4	nd
<i>Umbilicaria virginis</i> (Burnt Ridge)	1400	nd	5	9	34	11	2.3	2.1
<i>Rhizoplaca melanophthalma</i> (East Fork of Blacks Fork)	2600	nd	4	7	22	70	3	nd
<i>Umbilicaria virginis</i> (Vicinity of Bald Mountain)	1770	nd	50	1100	690	90	nd	nd
<i>Umbilicaria virginis</i> (Allsop Lake Basin)	1050	nd	11	15	68	8	2	nd

**Table 1 cont.** Mean concentrations of potential pollutant elements in sensitive indicators species from air quality biomonitoring reference sites in the High Uinta Wilderness Area (Wasatch-Cache National Forest).

	Elements (ppm except where indicated)			
	P	Br	Rb	Sr
<i>Rhizoplaca melanophthalma</i> (Burnt Ridge Trail)	1300	6	14	32
<i>Xanthoparmelia cumberlandia</i> (Burnt Ridge Trail)	2600	23	22	59
<i>Rhizoplaca melanophthalma</i> (China Meadows)	1300	3	17	23
<i>Umbilicaria virginis</i> (Burnt Ridge)	1180	5	5	13
<i>Rhizoplaca melanophthalma</i> (East Fork of Blacks Fork)	1300	2	23	60
<i>Umbilicaria virginis</i> (Vicinity of Bald Mountain)	1500	n d	12	13
<i>Umbilicaria virginis</i> (Allsop Lake Basin)	1000	3	17	16

Fig. 2 Lichen Biomonitoring Program and Baseline

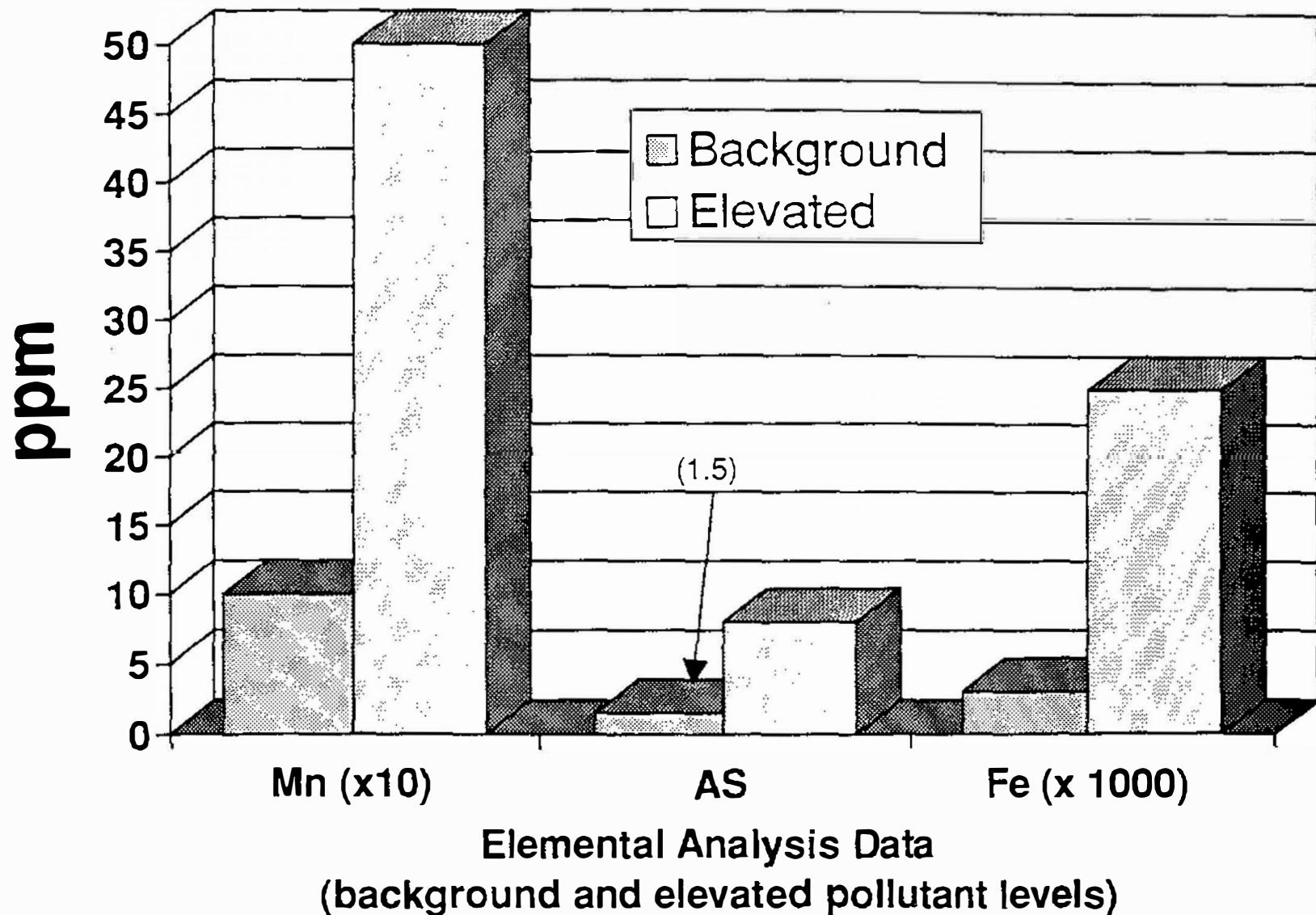


Fig. 2 cont. Lichen Biomonitoring Program and Baseline

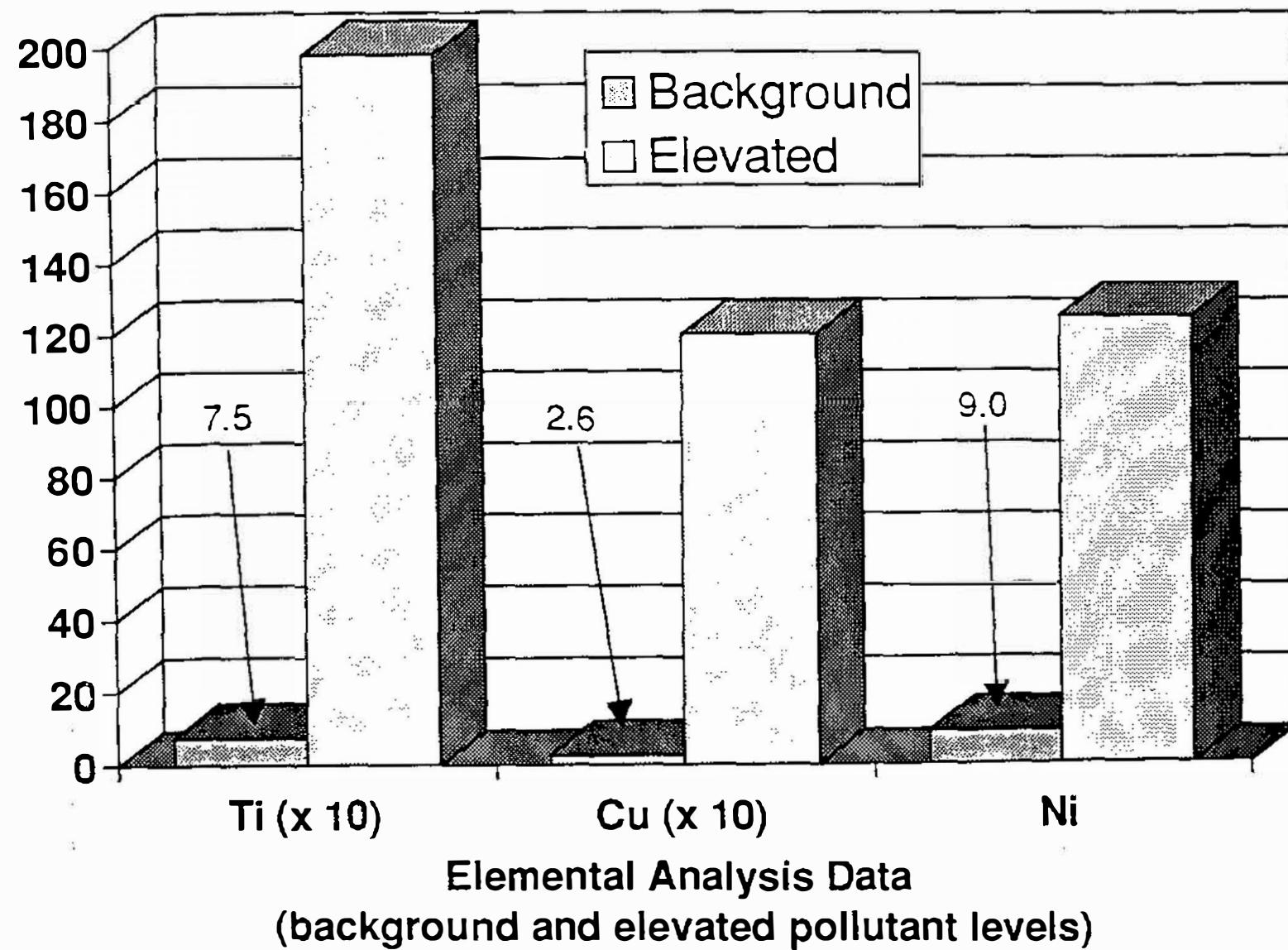
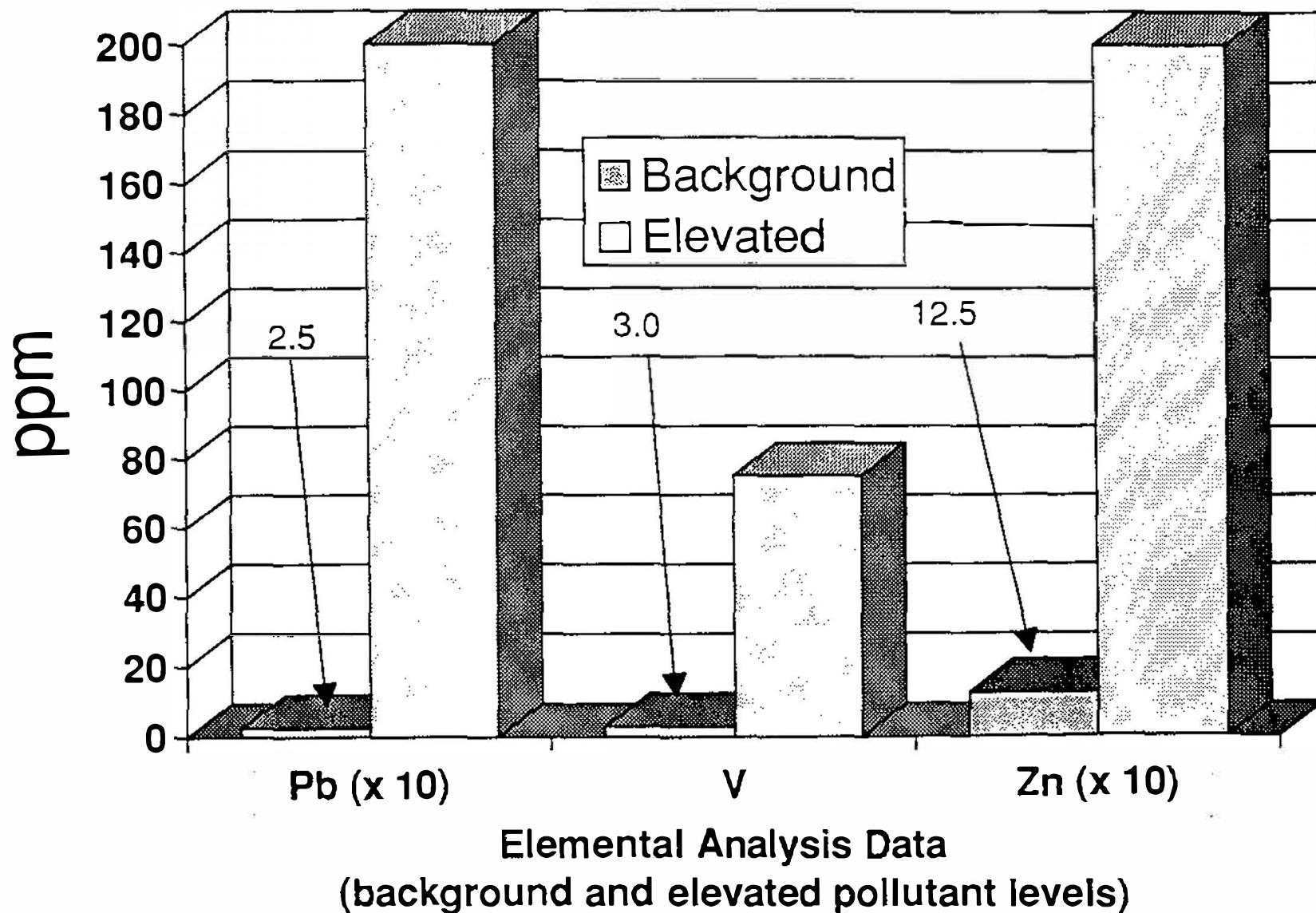


Fig. 2 cont. Lichen Biomonitoring Program and Baseline



and copper, in sensitive indicator species needs to be obtained. Additional floristic information is probably not necessary.

2. Elemental analysis of sensitive indicator species should be performed every 5 to 8 years, depending on significant changes in either local or regional air pollution patterns. Specifically, sulfur, copper, nickel, chromium and arsenic concentrations should be carefully monitored and evaluated against baseline data.
3. Re-evaluation of the lichen flora at the existing reference sites is generally unnecessary, unless sensitive indicator species begin to show either increasing levels of pollutant elements or significant changes in relative abundance.

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